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5.8 Electrical Power Systems

Electricity is the largest energy source in most facilities, powering HVAC equipment, motors, lighting, water heaters, and all types of industrial, office, and residential appliances and equipment. Electricity is generated primarily from fossil fuels and nuclear power sources, which have high pollution burdens. Only about one-third of the energy in the source fuels is delivered to the end user as electricity; the rest is lost to inefficiencies in generation and transmission of the power. With deregulation of the electric utilities, many new procurement options are becoming available, including the possibility of buying green energy from nonpolluting, renewable sources. The focus of this section is on procuring electricity from green sources and on ways to transfer it efficiently from delivery point at the facility to points of use. Further analysis of power systems is presented in *Section 5.8.1*, transformers are addressed in *Section 5.8.2*, and combined heat and power is addressed in *Section 5.8.8*.

Opportunities

Evaluate the pollution burden associated with electricity that a facility is using or considering for purchase, and seek opportunities to purchase green power. Consider the efficiency, reliability, and maintenance requirements of power systems whenever installing, renovating, or replacing equipment. There are opportunities within the facility's distribution system to save energy, increase equipment life, and reduce unscheduled outages. In some cases, efficiency improvements may be significant enough to justify replacement even if current equipment is still serviceable.

Technical Information

Efforts to reduce the environmental impact of electricity systems at any facility should include two parallel efforts: improving utilization efficiency on site and procuring green power.

UTILIZATION EFFICIENCY

Electric utility bills include both energy charges in kilowatt-hours and power demand charges in kilowatts. Rates may vary by season and time of day. Opportunities for improving the efficiencies of electrical power systems include evaluating and correcting voltage imbalances, voltage deviations, poor connections, undersized conductors, poor power factors, insulation leakage, and harmonics. Components to check in a maintenance program include transformers, conductors, switchgear, distribution panels, and connections at loads and elsewhere. Utilities penalize facilities with low power factors that require the utility to provide power-factor compensations.

Voltage imbalances are problematic differences between relative voltage levels among the three phases in part or all of a facility. Voltage imbalances result in preventable energy waste, excessive equipment wear, and premature equipment failure. Power demands on all three power phases should be virtually equal in order to maintain equal voltages in all phases. Problems with conductors, connections, and transformer settings may cause imbalances in any facility; however, supplying single-phase needs while maintaining three-phase balance is a challenge.

☑ Avoid imbalance in supply circuits by distributing single-phase loads such as lighting, single-phase motors, resistance heating, and plugloads among phases.

Designate or hire a Resource Efficiency Manager who will find and address power imbalances, suboptimal equipment, and other inefficiencies. The more critical the equipment, the more maintenance resources should be devoted to it. Maintenance programs for electrical distribution systems may be reactive, preventive, predictive, or proactive. With good recordkeeping, a manager can develop the tools needed for at least a predictive if not a highly proactive maintenance program.

Photo: Warren Gretz

This substation at the Palm Springs wind farm ties wind-produced electricity into the power grid.

GREEN POWER

The restructuring of the electric utility industry has created an opportunity for companies to offer electricity from renewable and nonpolluting sources to customers in states that have embraced deregulation. In many other states, where utilities are still regulated, green pricing is available as an option for customers who wish to pay a premium to support clean electricity sources. Executive Order 13123 directs Federal agencies to include provisions for the purchase of electricity from renewable energy sources in their requests for bids whenever procuring electricity. A number of funding mechanisms are available to pay the premium associated with green power. See FEMP's Utility Market Restructuring Web site for current information.

Because of the complex nature of the electric transmission and distribution system, and the varying definitions of "green" and "renewable" energy, there has been some confusion and misinformation in the green electricity marketplace. In response to this problem, the Center for Resource Solutions, a San Francisco-based nonprofit organization, has developed the Green-e Renewable Electricity Program to certify green power providers that meet its criteria. Green electricity providers being considered for a contract should be accredited as such by the appropriate state board and should carry the Green-e certification. The Center for Resource Solutions also has a parallel program to accredit green pricing programs from regulated utilities.

References

Total Efficiency Network, Washington State University Energy Program; (888) 634-2558; www.energy.wsu.edu/ten/.

FEMP's Utility Market Restructuring Web site: www.femp-restructuring.org/.

Contacts

Center for Resource Solutions, Presidio Building 49, P.O. Box 29512, San Francisco, CA 94129; (415) 561-2100, (415) 561-2105 (fax); www.resource-solutions.org.

MAINTENANCE TYPE AND PHILOSOPHY

REACTIVE: Repairs are made or components are replaced only upon failure.

PREVENTIVE: Includes inspecting, diagnosing, and servicing electrical systems to minimize future equipment problems or failures.

PREDICTIVE: Uses tests to predict the required service intervals, and targets equipment with the greatest service needs.

PROACTIVE: Employs failure analysis and predictive analysis as feedback to improve maintenance practices.